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Original Article

Propagation Planning and Hatchery Construction for Bunnei (*Barbus Sharpeyi*, Gunther 1874) in Basra-Iraq

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Abstract

Bunnei is one of the most important species in the Southern Iraqi marshes and Tigris-Euphrates basin. Their populations declined dramatically due to the negative effect of the marsh drainage program which had started in 1992. The experience of three successive seasons of artificial breeding of Bunnei, as well as all the available data, is used in this article to aid successful planning for hatchery construction and propagation processes. Biological data were arranged in basic desk data table, to be used for the planning and hatchery construction. All the hatchery operation steps for the induced spawning of Bunnei have been shown as a function of time. It was found that we need nine days to complete the production of one batch of first feeding larvae, with four days time lag between two successive batches, so that three batches of larvae could be produced each seventeen days for the same group of hatching jars. During each spawning season of Bunnei, which is extended for 45 days, ten batches from each set of production equipments could be selected. For the planning of hatchery equipments, the calculations showed that from total weight of 30kg female Bunnei it can produce 0.61 million first feeding fry. For such production sixteen pieces of hatching jars (10-L) and eight larval rearing tanks (850-L) are needed. All the important parameters for the production of 30,000,000 first feeding larvae were calculated, which will comprise a base line study for further improvements.

Key Words: Bunnei, *Barbus sharpeyi*, Propagation planning, Hatchery construction.

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Introduction

The restored Iraqi marshlands showed a sharply decline in the production of the commercial native fish species. Bunnei, *Barbus sharpeyi* is the commonest local species in the marshes catches, its stocks were declined dramatically during the past ten years. Now Bunnei is found only in Al Huwaizha marshes which had less affected by the massive drainage structures

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mostly built in 1990, diverted water from Tigris and Euphrates rivers away from the marsh lands. Recently, there is a highly demand of Bunnei fingerlings for the enhancement of its stocks in the marshes. The planning of the hatchery activities is a very important step in the production of fingerlings. One prerequisite of intensive fish culture technology is to have healthy fish seeds in the required amount available, and this could be realized only with preliminary propagation planning. In planning of fish hatcheries one has to start from the basic data of the reproduction biology, propagation and nursing (Kepenyes, 1984). The required basic biological informations on Bunnei could be found in many articles (Al-Hamed, 1966; Al-Hamed, 1972; Al-Jerian, 1974; Al-Hakeim, 1976; Yesser, 1988; Jasim, 1988; Al-Daham and Jasim, 1993; Neikpeyi, 1994 and Al-Mukhtar, et al. 2006). Many trials have been done for propagating of Bunnei in the region. Farga and Firas (1988) who worked on three important local fish (*Barbus sharpeyi, Barbus xanthopterus and Barbus grypus*) and put a very important basic data table for the induced spawning of these species. Al-Nasih (1992) published the first article on the production of Bunnei. In this article, some important informations on induced spawning and embryonic development of Bunnei larvae were recorded. The most recent works were done in Fish Hatchery of Marine Science Center, Iraq, after the restoration of the dried marshes. The first study was conducted by Ali et al. (2005), in which a good number of Bunnei fingerlings were introduced into Al Hammar marsh. The second work was done by Al-Mukhtar (2007) which expressed the results of the enhancement of the Bunnei stocks in the marshes during 2006. Abdul-Kareem and Moathidi (1994) and Moazedi (2000) showed the pioneer works on this species in south Iran (Khuzestan). This article aimed to put a firm plan for Bunnei hatchery, in which production size can be predicted along with all the required equipments and funds for that production.

Materials and Methods

The methodology of this article depends on two important directions. The first direction depends on the data of available published and unpublished reports in Iraq and Iran about Bunnei propagation. These studies had important information about the age of brooder, hormone dosage, water temperature, water current, brooders fecundity, stocking capacity in hatching jars and larvae incubators. These data were used for the complement of the missing data of second direction. The second direction was the work which had been done in Freshwater Fish Hatchery of Marine Science Center, where three successful induced spawning trails for Bunnei had been carried out in three successive seasons 2004-2006 (Ali, et al. 2005 and Al-Mukhtar, 2007). By using the data of both directions the required calculations had been done for the propagation plan and determination of hatching requirements. These calculations have been done in many steps, the first step was the constructing of a basic desk data table. The second step was the usage of this basic desk data table for condtructing hatchery time planning, calculating number of patches and the number of important parameters of the hatchery, which include the number of brooders, number of production units and finally the number of first feeding fry. The steps of Bunnei propagation plan were done according to Kepenyes (1984). The arrangement of Bunnei propagation plan will consider all the important parameters and steps as a function of time. The following formula was used for calculating the time period required for several hatching batches:-

$T_n = T_1 + T(n-1)$……………………..………(1)

Where:

T_n= Total time (days) required for number (n) batches.

T_1= Time (days) required for one batch.

T= Time interval (days) between two successive batches.

n= Number of batches.

The Basic desk data table will be used to construct a flow chart for all the important parameters used in planning of the propagation of Bunnei. The flow chart will show all the quantitative relations between the important propagation parameters which can assist the hatchery designer in calculating the production size and the required facilities for the production. The letter (Y) in the flow chart indicates the parameter and its code number which will be used in the relationships as follows:

Y1= Female spawning tank.
Y2= Male spawning tank.
Y3= Total weight of females.
Y4= Total number of females.
Y5= Total number of males.
Y6= Total weight of males.
Y7= Weight of ripe females.
Y8= Weight of ripe male(s).
Y9= Number of dry eggs (Million piece).
Y10= weight of dry eggs.
Y11= Total milt size.
Y12= Number of fertilized eggs (Million piece)
Y13= Number of hatching jars.
Y14= Number of hatching eggs.
Y15= Number of larval rearing tanks.
Y16= Number of first feeding fry.

The letter (X) above the arrows with numbers indicates the direction of the relationships between the parameters, while the values below the arrows show the quantitative relation between each two parameters. These quantitative relationships will be used to calculate all the required components of the plan starting from the weight of brooders and ending with the required number of the first feeding larvae.

Results and Discussion

1- Time Planning:

The Induced spawning steps for production of Bunnei larvae in the hatchery could be shown as a function of time (Fig. 1). The time (in days) is shown on the horizontal axis, operation sequence of different units is showed by the lines between the solid black points.

Fig. (1) The time plan for Bunnei (*B. sharpeyi*) to produce three batches of first feeding larvae, with 4 days time intervals.

The letters on the solid black points refer to different processing stages of larval production. For Bunnei production these stages could be stated as follows:

A and E: Transportation of brooders (Males and Females) to the hatchery. In case of Bunnei this could be carried out during March when water temperature is not lower than 18°C and when there is a big spawning migration of Bunnei to the spawning area in the marshes (Al-Mukhtar, et al. 2006).

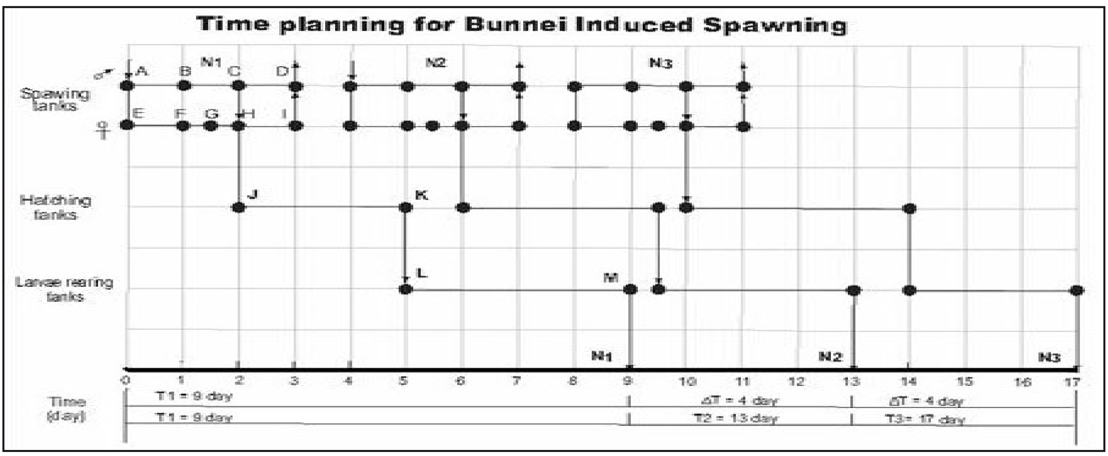

Fig. 1: The time plan for Bunnei, *B. sharpeyi*, to produce three batches of first feeding larvae, with 4 days time intervals.

B: Hormone administration of males. It was found that it is better to inject males with the first injection of females (Al-Mukhtar, 2007).

F: Anesthetizing of females and marking. Calculating the hormonal dosage and administration of first injection (10% of the total dosage). These operations could be after 24h of acclimatization in brooders tanks inside the hatchery.

G: Second injection of females (90% of the total dosage).

C and H: Anesthetizing, striping, mixing of sexual products (dry method).

J: Adding fertilizing solution, washing and removing of stickiness, tannin treatment for elimination of reversible stickiness, washing with clear water to complete swelling and placing in the hatching jars.

D and I: Brooders removal to rearing ponds, after fungal treatment and coding.

K and L: Transfer of hatching larvae to the larval rearing incubators (tanks).

M: Transport of the first feeding larvae, to different fry production system.

N1: The first batch of first feeding larvae, which could be transferred to indoor or outdoor rearing system.

All the time periods were calculated according to the hatchery condition where water temperature was 24°C.

2- Planning the production of batches during the spawning season:

According to Fig. (1), the needed time for the production of the first batch (N1) of first feeding larvae is nine days (T1= 9 days). The next batch (N2) may be started on the fourth day of the first batch, which means that the time interval between each two successive batches would be four days. So that 13 days are needed for the production of two batches.

In the case of Bunnei, it could be calculate the total number of batches (n) during the spawning period, which started on 15th March till the late April (Al-Mukhtar, et al. 2006) (Average= 45 days), as follows (From formula1):

$Tn= T1+T (n-1)$

$45= 9+4 (n-1)$

$45–9= 4 (n-1)$

$n= 10$ batches

These calculations would enable us to estimate the final required production and all the required sizes and numbers of the hatchery components.

3- Calculating the important parameters:

The most important parameters that must be calculated are:

Number of brooders (a).

Number of production units (b).

Total number of first feeding larvae produced in each c. batch (T1) and the total number along spawning season (Tn).

The above parameters might be calculated by using the basic desk data (Table 1), and arranged in a flow chart (Fig. 2). The flow chart showed the quantitative relationships between the parameters and how to calculate each one from the related parameters.

Bunnei propagation flow chart enables us to calculate all the important parameters for constructing the hatchery. As example: X3.7 indicates the percent of females that will response to hormone treatment which was (0.75) for Bunnei (Ali, et al. 2005). X12.14 indicates the percent of fertilized eggs that will hatch which was calculated for Bunnei to be 0.80% (Al-Mukhtar, et al. 2006), and so on.

This flow chart will help in estimating the final production and all the required units. By knowing the size of broodstock available in the hatchery, one can estimate the total production of first feeding larvae.

Table 1: The hatchery basic desk data for Bunnei induced spawning:
(From Farga and Firas 1988; Ali et al. 2005 and Al-Mukhtar 2007).

Hatchery Basic Desk Data for Bunnei Induced Spawning	
Sexual Maturity:	Two years
Smallest brooders length:	Male: 24.8cm female: 37.0cm
Smallest brooders weight:	Male: 183g female: 734g
Spawning season:	10 march-Late April
Spawning Habitat:	On aquatic plant
Parental care:	Without
Natural spawning:	Not examined
Average No. eggs/female:	109380
Number of eggs/kg:	92870
Average eggs weight (Spawning fecundity):	100 g/kg
Size of dry eggs:	1.3-1.5ml
Size of swollen eggs:	2.3-2.5ml
No. of eggs/g(dry):	500-600
No. of eggs/g(wet):	350-380
Induced Spawning sex ratio:	3:1
Percent of female spawned after P.G injection:	35 - 45%
Milt volume:	1-3ml/male
Milt required for each 1 kg of eggs:	6-7(ml)
Quantity of eggs for each 10L Zoug jar: (g/unit):	120-170
Fertilization rate:	70-75
Hatching time:	3-3.5 day
Larvae survival rate:	85-95
Time of First feeding:	3-3.5 day
Hatching water temperature:	22-24°C

Practical data:
In an experiment to design a hatchery for Basrah Agricultural Directorate for the production of 30,000,000 first feeding larvae of Bunnei (*Barbus sharpeyi*) during one spawning season, the following calculations were found according to the above sections 1, 2 and 3:
According to section (2), number of batches= 10.
Number of first feeding larvae in each batch (Y16)= 3.0mpc (Million piece).

From Figure (2) for each batch, it can calculate the following:
Number of hatched larvae (Y14)= 3.0/0.9= 3.3mpc.
Number of rearing tanks (Y15)= 3.3/0.= 33unit.
Number of fertilized eggs (Y12)= 3.3/0.8= 4.1mpc.
Number of dry eggs (Y9)= 4.1/0.7= 5.5 mpc.
Weight of dry eggs (Y10)= 5.5/0.5= 11kg.
Number of hatching jar (Y13)= 11000/140= 78jar.
Weigh of ripe female brooders (Y7)= 5.5/0.05= 110kg
Weigh of female brooders (Y3)= 110/0.75= 146.7kg.
Number of female brooders (Y4)= 146.7/1.5= 97.8 female.
Size of female tanks (Y1)= 97.8 x 1= 97.8m3.
Number of male brooders (Y5)= 97.8 x 3= 293.4male.
Weight of male brooders (Y6)= 293.4 x 0.75= 220.05 kg.

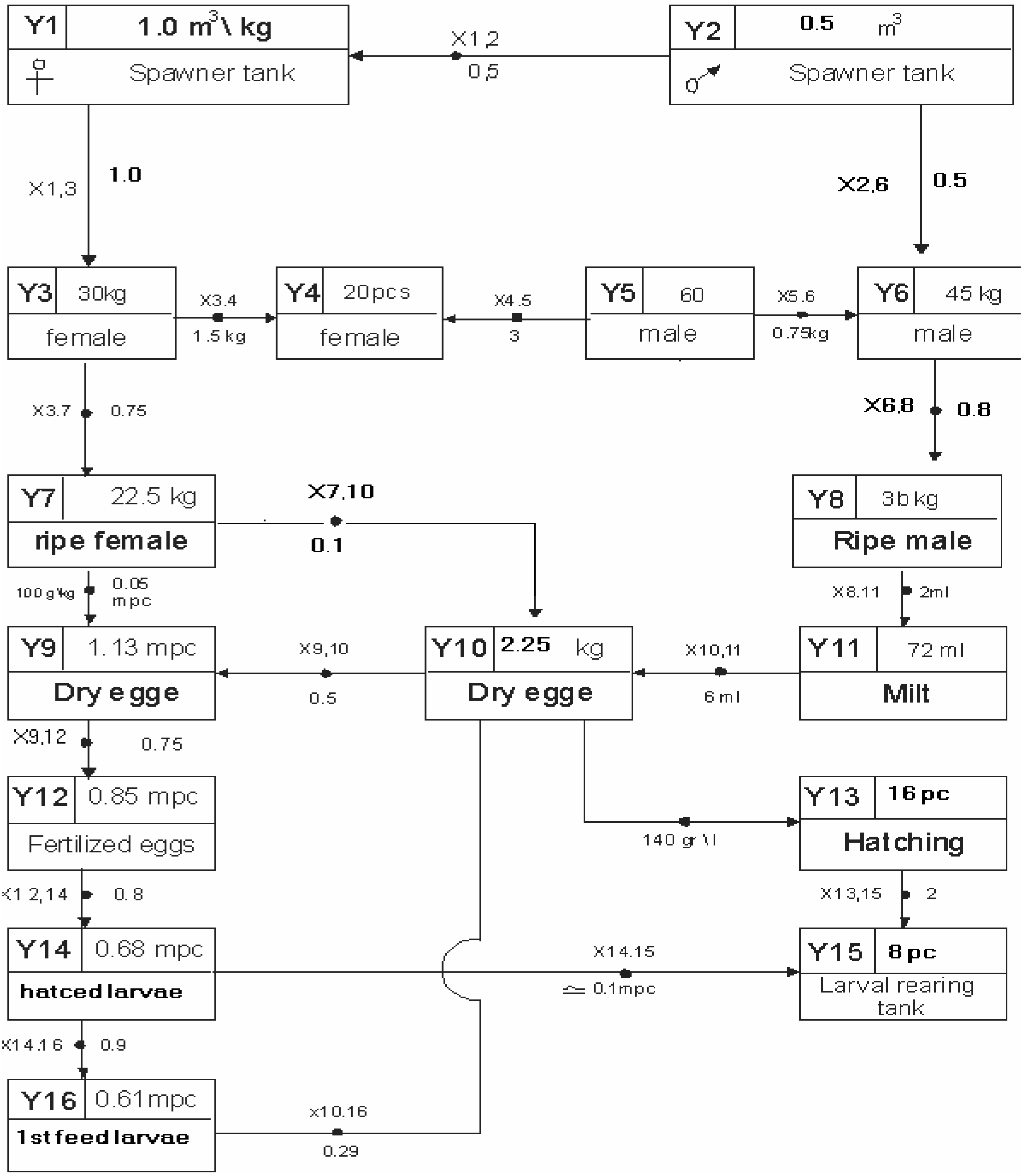

Fig. 2: Flow chart for the important parameters in Bunnei, *B. sharpeyi*, hatchery and the quantitative relationship between them.

Size of male tanks (Y2)= 220.05 x 0.56= 123.2m^3.

From this example one can calculate any required production and all the facilities in the hatchery, the required amount of hormones and chemicals and the time plan in hours and days for the production.

It was found that the requirements and time plan for Bunnei hatchery were different from that for common carp which had been mentioned by Kepenyes (1984), except the time period for batches which was similar. The above Calculations are needed in Iraq for other species, especially the Chinese carp, which are used broadly in fish hatcheries. The case is more complicated if 3-4 species are hatched together during the same spawning season.

References

Abdul-Kareem, Y.P. & Moathidi, J. 1994. Induced spawning and culture of Bunnei (*Barbus sharpeyi*). The scientific research results of the Iranian Fisheries Org., Tehran, Iran.

Ali, M.H., Al-Noor, S.S. & Al-Mukhtar, M.A. 2005. Enhancement of Bunnei, *Barbus sharpeyi* (Gunther, 1874) stocks, Marsh lands restoration programme. Marine Science Centre.

Al-Daham, N.K.; Jasim, A. A. 1993. The Fecundity of the Barbin *Barbus sharpeyi* in south Al Hammar Marsh , Iraq. Marina Mesopotamica, 8 (2), pp. 366-377.

Al-Hakeim, A.H. 1976. Morphology and length at first maturity of Bunnei *Barbus sharpeyi* and *Barbus grypus* in Al Razaza Lake. M.Sc., Baghdad University.

Al-Hamed, M.I. 1966. On the age and growth of three Cyprinid fish of Iraq. Government Press.

Al-Hamed, M.I. 1972. On the Reproduction of 3 Cyprinid Fish of Iraq. Freshwater Biology. 2 (1), pp. 65-76.

Al-Jerian, A.A. 1974. Age and growth of two species of Iraqi fish *Barbus sharpeyi* and *Barbus xanthopterus* in Al-Therthar reservoir, Iraq. M.Sc., Baghdad University.

Al-Mukhtar, M.A. 2007. Propagation of *Barbus sharpeyi* (Gunther, 1974 (sic)) in Basrah during spring 2006 for the enhancement of the marshes stock. The Arabian Sea International Conference on Science and Technology of Aquaculture, Fisheries and Oceanography, State of Kuwait.

Al-Mukhtar, M.A., Al-Noor, S.S. & Saleh, J.H. 2006. General reproductive biology of Bunnei (*Barbus sharpeyi* Gunther, 1874) in Al Huwaizah Marsh, Basra-Iraq. Turkish Journal of Fisheries and Aquatic Sciences. 6 (2), pp. 149-153.

Al-Nasih, M.H. 1992. Preliminary observations related to the culture of *Barbus sharpeyi* bunni. Journal of Aquaculture in the Tropics. 7 (1), pp. 69-77.

Farga, A. & Firas, M.C. 1988. Induced spawning technique of three Iraqi fish bunni (*Barbus sharpeyi*), shabout (*Barbus grypus*) and gattan (*Barbus xanthopterus*). Al Wehda Fish Hatchery, Iraq.

Jasim, A. 1988. Reproductive biology of *Barbus sharpeyi* Gunther 1874 (Pisces, Cyprinidae) South Al-Hammar Marsh, Iraq. M.Sc., University of Basrah.

Kepenyes, J. 1984. Planning of fish hatcheries (ch12). In: Inland Aquaculture Engeneering, United Nation Development Program. FAO.

Moazedi, J. 2000. Induced spawning and monoculture of Bunnei in earthen ponds. First National Symposium on Barbus fish of Iranian Fisheries Organization, Khuzestan Fisheries Centre.

Neikpeyi, M. 1994. The biology of *Barbus sharpeyi* and *Barbus grypus* in Khuzestan Province. The Scientific Research Results of the Iranian fisheries Org., Tehran, Iran.

Yesser, A.K.T. 1988. Seasonal variation in the chemical composition in muscles and gonads of two Iraqi fish *Barbus luteus* and *Barbus sharpeyi* in relation to their reproductive cycle in Hor Al-Hammar. M.Sc., University of Basrah.